Work Area Protection and Traffic Control Manual

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9.30.94

California Joint Utility Traffic Control Committee

The Gas Company

SDGE
An Enova Company

AT&T

PACIFIC BELL

PG&E

DEPARTMENT OF WATER AND POWER
CITY OF LOS ANGELES
FOUNDED 1902

SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

GTE

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Introduction to the Second Edition

The Traffic Control Plans and associated text depicted in this Manual conform with Federal D.O.T., Chapter 5 of the State of California Manual of Traffic Controls and the WATCH handbook.

This manual is coordinated and prepared by the California Joint Utility Traffic Control Committee and Forkert Engineering, a professionally licensed engineering firm. It provides the basic standards for the safe movement of traffic upon highways or streets in accordance with Section 21400 of the California Vehicle Code. Traffic control includes safe protection for the public, motorist, cyclist, pedestrian and worker. It is the responsibility of the contractor or organization performing work on, or adjacent to, a roadway to install and maintain such devices which are necessary to provide safe passage for the traveling public through the work area and for the safety of the workers.

This text is not intended to establish or create a legal standard. The criteria for the position, location, manner of installation, and the use of such signs, lights and devices are furnished solely for the purpose of information and guidance. This manual will be updated as required to conform with the changes in the Federal D.O.T., Caltrans and WATCH publications.

This second edition offers a new urban section plus revision to the original fourteen drawings and added metrication of the entire manual.

California Joint Utility Traffic Control Committee;

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Public Utilities Code

Pacific Bell, General Telephone, and AT&T as telephone utilities, have been granted by the State the right to use public streets. This grant, known as the state franchise is found in Section 7901 of the California Public Utilities Code. Section 7901 provides that:

"Telegraph or telephone corporations may construct lines of telegraph or telephone lines along and upon any public road or highway, along or across any of the waters or lands within this State, and may erect poles, posts, piers, or abutments for supporting the insulators, wires, and other necessary fixtures of their lines, in such manner and at such points as not to incommode the public use of the road or highway or interrupt the navigation of the waters."

Southern California Edison, as an electric utility, has been granted by cities and counties the right to use public streets. This grant, known as the city or county franchise is found in Section 6265 of the California Public Utilities Code. Section 6265 provides that:

". . . and every electric franchise so granted confers upon the grantee thereof the right to use, or to construct and use, poles, wires or conduits and appurtenances for the purpose of transmitting and distributing electricity for all purposes, under, along, across, or upon the public streets, ways, alleys, and places as they now or hereafter exist within the municipality."

San Diego Gas & Electric and Pacific Gas & Electric Companies, as electric utilities and gas utilities have been granted by cities and counties the right to use public streets. This grant, known as the city or county franchise is found in Section 6265 of the California Public Utilities Code. Section 6265 provides that:

"Every gas franchise granted pursuant to this chapter confers upon the grantee the right to use, or to lay and use, gas pipes and appurtenances for the purpose of transmitting and distributing gas, every oil franchise so granted confers upon the grantee thereof the right to use, or lay and use, oil pipes and appurtenances for the purpose of transmitting and distributing oil or products thereof; every industrial gas franchise so granted confers upon the grantee the right to use, or lay and use, industrial gas pipelines and appurtenances for the purpose of transmitting and distributing industrial gas; . . . and every electric franchise so granted confers upon the grantee thereof the right to use, or to construct and use, poles, wires or conduits and appurtenances for the purpose of transmitting and distributing electricity for all purposes, under, along, across, or upon the public streets, ways, alleys, and places as they now or hereafter exist within the municipality."

Southern California Gas Company, as a gas utility, has been granted by the cities and counties the right to use public streets. This grant, known as a city or county franchise, is found in Section 6265 of the California Public Utilities Code. Section 6265 provides that:

"Every gas franchise granted pursuant to this chapter confers upon the grantee the right to use, or to lay and use, gas pipes and appurtenances for the purpose of transmitting and distributing gas; every oil franchise so granted confers upon the grantee thereof the right to use, or lay and use, oil pipes and appurtenances for the purpose of transmitting and distributing oil or products thereof; every industrial gas franchise so granted confers upon the grantee the right to use, or lay and use, industrial gas pipelines and appurtenances for the purpose of transmitting and distributing industrial gas; . . ."

The Department of Water and Power of the City of Los Angeles, as an electric and water public utility owned and operated by a municipal corporation, has been granted the right to use the public streets by Section 10101 of the California Public Utilities Code, which provides that:

"There is granted to every municipal corporation of the state the right to construct, operate and maintain water... pipes, mains and conduits, electric light and power lines..., all with the necessary appurtenances, across, along, in, under, over, or upon any road, street, alley, avenue, or highway".

Objectives

Provide:

1. Safety protection for the public, motorist, cyclist and pedestrian.
2. Safety protection for utility employees, their contractors and equipment.
3. Safe access for police, fire and rescue vehicles.
4. Guidelines for safe, effective work areas; and to warn, control, protect and expedite vehicular and pedestrian traffic.
5. Traffic control guidelines provide for the basic principles that govern the design and usage of warning signs, lights and devices placed upon any public roadway or street.
6. Offers metric solutions to traffic control planning and set-up. All metric conversion charts meet or exceed the english equivalent

Work Area Planning

Work should be planned in advance to permit employees and equipment to move safely into position, accomplish the job in a safe and skillful manner and move out of the area as soon as possible upon completion.

The employee in charge must review and advise the workers on how to set up, maintain and remove the traffic control devices.

In planning for the safety of all involved, consider the traveling public and remember:

1. They must be warned sufficiently in advance to allow time to think and react.
2. They must have time to regulate their speed, to allow them to pass through the guidance pattern with safety and ensure an even flow of traffic.
3. The need for decision making must be reduced to a minimum. This can be done with a planned guidance pattern.

A checklist of items to be considered in planning should include the following:

1. Estimated time required to complete the job in order to determine short-term or long-range operations.
2. Volume and speed of traffic.
3. Changes in traffic conditions during the job operation.
4. Local ordinances and permit requirements.
5. Set up shall always start with the advance warning sign and work back to the jobsite.
6. The most effective traffic guidance pattern to be used.
7. Determination of the number and types of safety devices, cones/delineators, signs, flags, flashers, barricades, flashing arrow signs, etc., required for the job.
8. Flaggers, while setting up protection and during the job operation, if required.
9. Effective utilization of utility vehicles for maximum protection.
10. When lanes are to be closed, place the lane closure signs well in advance of the taper. If a minimum of ten-foot (3 meter) lane width cannot be maintained, the lane must be closed.

Warning and Construction Signs, Guards and Barriers

Sign sizing:

45 mph (70 Km/h) or greater = 48" (122cm) sign minimum

40 mph (60 Km/h) or less = 36" (92cm) sign minimum

Approved warning signs, barricades, cones/delineators, guards, flags, flares, reflectors and lights at night, shall be installed and properly maintained wherever hazards exist due to moving or stationary vehicles, open excavations, construction and maintenance operations and similar work. Approved equipment and methods for work area protections are displayed in this manual.

Warning equipment shall be placed so as to provide adequate notice to motorists, cyclists, or pedestrians that they are approaching an excava-

tion, obstruction, or other hazard.

Warning signs shall be removed as soon as the excavation, obstruction, or other hazard is cleared.

Flaggers will be provided where approved signs or barricades do not provide adequate traffic control.

Leave the Work Area Orderly at End of Work Period

Before leaving a work area, it is necessary that proper warning devices be properly placed to protect motorists and pedestrians.

1. Ensure that the area is properly barricaded and that flashing lights, where required, are functioning satisfactorily.
2. Make sure that equipment is secured and that the work area is left orderly.

Night Operations

In order to provide enhanced warning and safety during twilight and night operations, the following steps should be adhered to:

1. When the work area is to be illuminated by use of flood lights, the light placement shall be such that the light beams are not hazardous to oncoming traffic.
2. All warning signs and cones/delineators shall be illuminated or reflectorized.
3. Flashing or rotating amber lights on vehicles may be used when the vehicles are blocking established traffic lanes or for additional work area protection.
4. Flaggers must be illuminated, visible to approaching traffic, and wear approved reflectorized garments.

Note: Flares and red emergency reflectors are strictly for emergency situations and must not be used as substitutes for standard work area warning devices. Flares shall not be used in combustible or high fire areas.

Channelizing Devices

Channelizing devices are elements in a total system of traffic control devices for use in construction and maintenance operations. These elements shall be preceded by a subsystem of warning devices that are adequate in size, number, and placement for the type of roadway on which the work is to take place.

Approved channelizing devices shall be used for the following purposes:

1. To channel and divert traffic in advance of work zones.
2. To define traffic lanes through the work zone.
3. To define a change in the position of the existing lanes around the work zones.
4. To define curves and the edges of the roadway on detours.
5. To separate opposing lanes of traffic.

Correctly positioned cones/delineators provide an excellent guidance path. Improperly positioned cones/delineators only confuse drivers.

Spacing of cones/delineators and length of taper with respect to oncoming traffic, shall be in accordance with the following tables

Table 1: English

SPEED LIMIT (mph)	SPACING (feet)
25 or less	10 or less
Over 25	Posted Speed limit or less

Example: Posted Speed Limit of 45 mph. Spacing not to exceed 45 feet

Table 2: Metric

SPEED LIMIT (Km/h)	SPACING (Meters)
40 km/h or less	3 or less
Over 40 km/h	Posted Speed limit or less

Example: Posted Speed Limit of 70 Km/h. Spacing not to

exceed 13.7 meters

Table 3: English

Approach Speed mph	Taper Length L Feet	Number of Cones/ Delineators for Taper*	Max. Spacing of Cones/ Delineators Along Taper Feet
25 or less	125	6	25
30	180	7	30
35	245	8	35
40	320	9	40
45	540	13	45
50	600	13	50
55+	1,000	20	50

*Based on 12-foot wide lane. This column is also appropriate for lane widths less than 12 feet.

Table 4: Metric

Approach Speed (km/h)	Taper Length L meters	Number of Cones/ Delineators for Taper*	Max. Spacing of Cones/ Delineators Along Taper Meters
40 or less	40	6	8
45	55	7	9
50	75	8	11
60	100	9	12
70	155	13	14
80	185	13	15
85+	305	20	15

*Based on 3.7 meter wide lane. This column is also appropriate for lane widths less than 3.7 meters

Spacing of cones/delineators, to define the work area shall never exceed ten feet (3 meters). Any number of cones/delineators may be used as long as they do not confuse oncoming drivers.

Formulas:

For lanes over 12 feet (4m) use the following formulas:

45 mph or greater $L = S \times W$

70 km/h or more $L = S \times \frac{2}{3} W$

40 mph or less $L = \frac{WS^2}{60}$

60km/h or more $L = \frac{WS^2}{150}$

Examples:

19' lane and 50 mph speed limit,

$L = 50 \times 19 = 950'$ Taper

14' lane, 40 mph speed

$L = \frac{14 \times 40^2}{60} = \frac{14 \times (40 \times 40)}{60} = 373'$ Taper

6 m lane and 60 Km/h speed limit,

$L = \frac{6 \times 60^2}{150} = 144m$

Use of Flaggers

The proper use of flaggers, where circumstances warrant, will not only provide protection for vehicular traffic, but will also provide protection for employees working in the immediate area. Flaggers must be alert and properly instructed. They are a valuable asset when it is necessary to divert the normal flow of traffic.

Flaggers are required as follows:

1. At all locations where warning and control devices cannot adequately control the moving traffic.
2. Where the job requires the use of one lane for two directions of traffic. (One flagger is required for each direction of traffic.)

Placement and equipment requirements are:

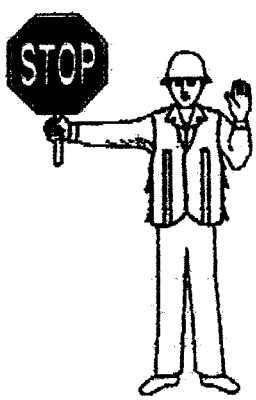
1. Flaggers shall be logically placed in relation to the equipment or operation so as to give adequate warning, and shall be stationed approxi-

mately 100 feet (30.5m) ahead of the possible impact point.

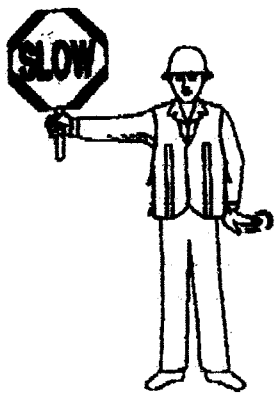
2. Flaggers shall wear approved warning garments. Reflectorized vests shall be used when flagging at night and the flaggers must be illuminated and visible to approaching traffic.
3. The warning sign, C-9 or C-9a, "Flagman Ahead" shall be placed ahead of the flagger. The distance between the sign and the flagger should be based on the average traffic speed, allowing approximately 100 feet (30.5m) for each ten miles per hour.
4. Flaggers shall be instructed in the proper fundamentals of flagging traffic before being assigned as a flagger.
5. Radios or other positive communications shall be used by flaggers who are not in visual contact with each other.
6. Flagging procedures and all signs and equipment comply with the Federal D.O.T., State of California Manual of Traffic Controls for Construction and Maintenance Work Zones and WATCH.

Flagging Procedures for Traffic Control

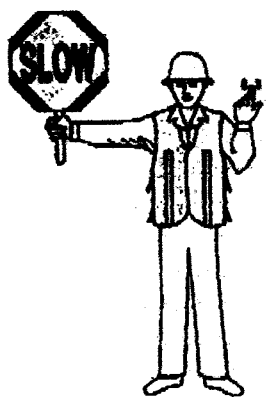
Flagging procedures for traffic control shall be in accordance with the following illustrations. Where flaggers are required, the Stop/Slow paddle shall be used



Stop paddle
Hold the STOP paddle in a vertical position at arm's length. The free arm should be raised with palm facing approaching traffic



Slow paddle
Hold the SLOW paddle in a vertical position at arm's length. The free arm should be raised and lowered slowly with the palm down



To proceed use Slow paddle
Hold SLOW paddle at arm's length and motion traffic to proceed with free arm.

Pedestrian Traffic

When the work area encroaches upon a sidewalk, walkway, or crosswalk area, adequate protection for the safety of pedestrians must be provided.

1. Barricades and cones/delineators may be used advantageously in defining pedestrian walkways.

2. Protect against any condition which would create a tripping, falling or slipping hazard.
3. When overhead work is being performed, the pedestrian passage area below must be rerouted or protected.
4. A minimum walkway width of 48" (122cm) must be maintained at all times for safe passage through the work area.

Bicycle Traffic

1. Whenever possible, maintain bicycle lanes.
2. Provide bicycle warning signs where appropriate.

Special Considerations

1. Where physical conditions are such that hills, curves, buildings, vegetation, etc., reduce or obscure driver view, additional precautions become necessary. Oncoming traffic should be alerted to potential hazards by the suitable use of signs, flaggers, barricades, flags, flashers, or traffic cones.
2. Whenever possible, maintain ingress and egress for private property.
3. In cases of vital services such as hospitals, police stations, fire stations, ingress and egress shall be maintained at all times.
4. Closely spaced intersections also require special consideration for sign and delineator spacing (refer to drawings 6, 7, 10, and 11). Plan view drawings may be used individually or in combination.

Barricades

The function of barricades is to separate the motorist from objects or unusual situations created by construction or maintenance activities in or near the traveled way. Barricades should not be used to guide motorists through the transition or work zones.

The barricade would not be used where a collision with the barricade would be more severe than a collision with the object being separated. At such locations, cones/ delineators, or other less rigid devices should be used.

Barricade design:

Barricades for vehicular traffic shall be of three types: Type I, Type II, and Type III.

Markings for barricade rails shall be alternate orange and white stripes sloping downward at an angle of 45 degrees. The entire area of orange and white shall be effectively reflectorized. The predominant color for other barricade components shall be white.

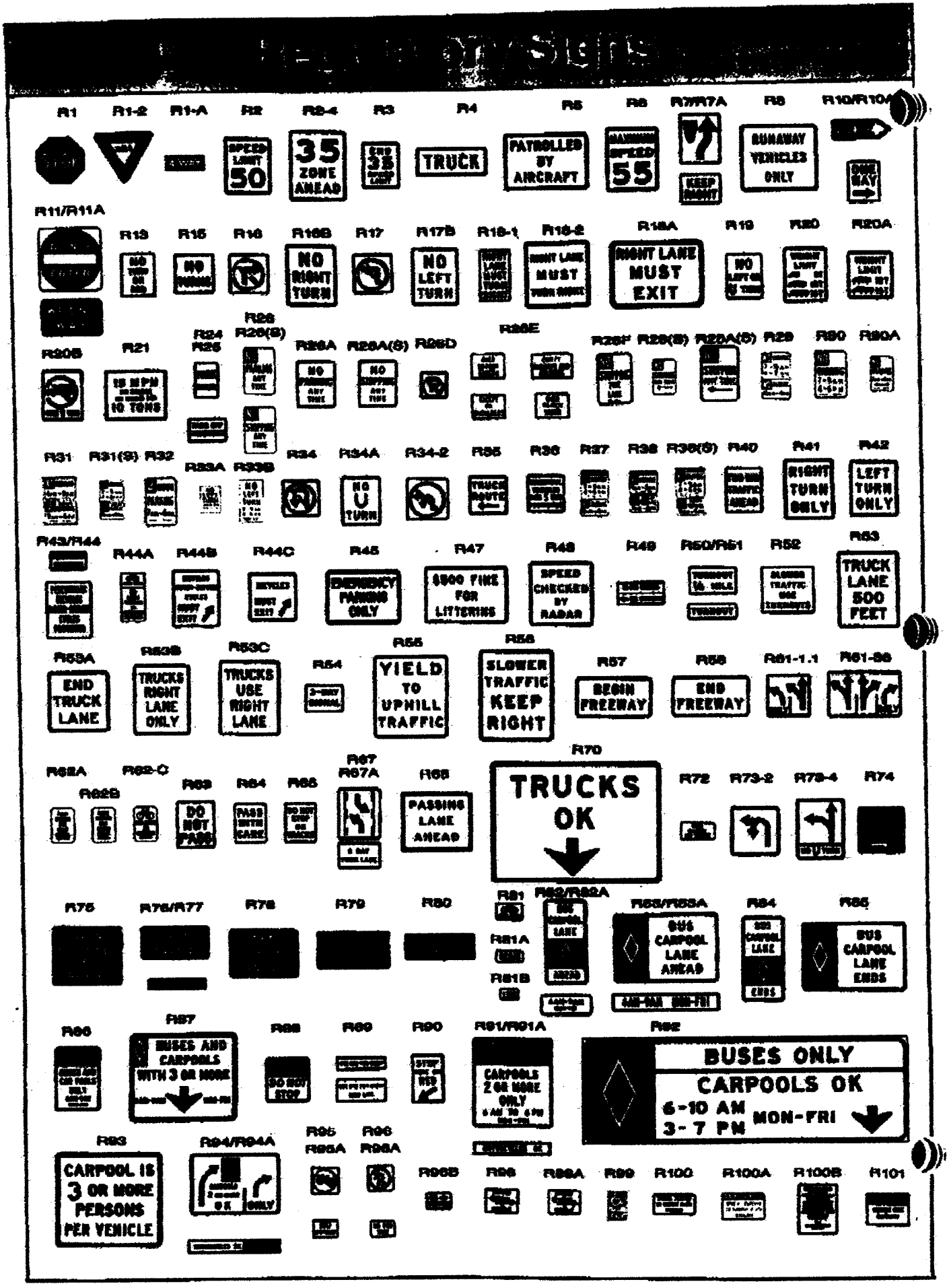
Flashing Arrow Signs (FAS)

Table 5: English

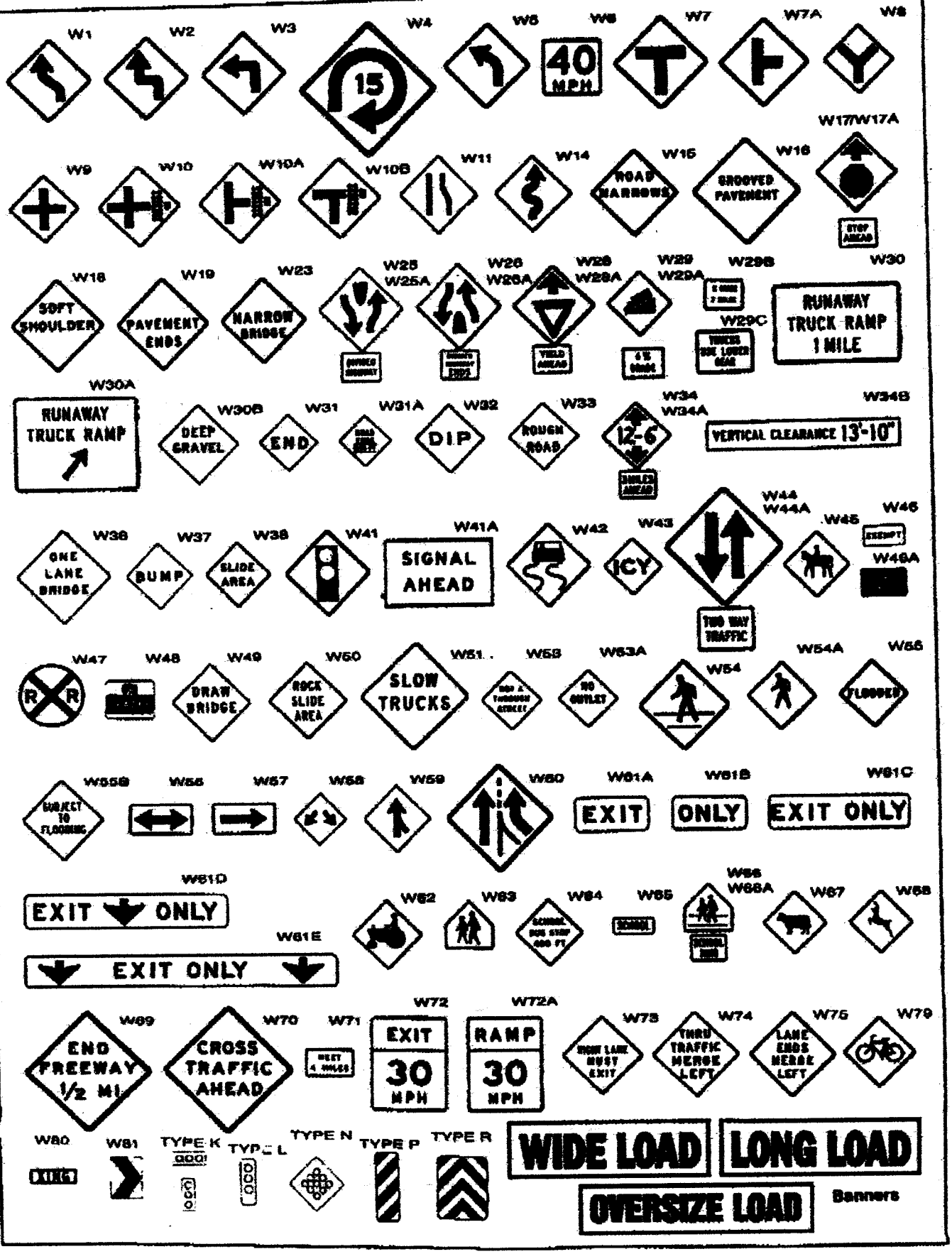
Type	Min. Size	Min Number of Panel Lamps	Min Legibility Distance
A	24" x 48"	12	1/2 mile
II	36" x 72"	13	3/4 mile
I	48" x 96"	15	1 mile

Table 6: Metric

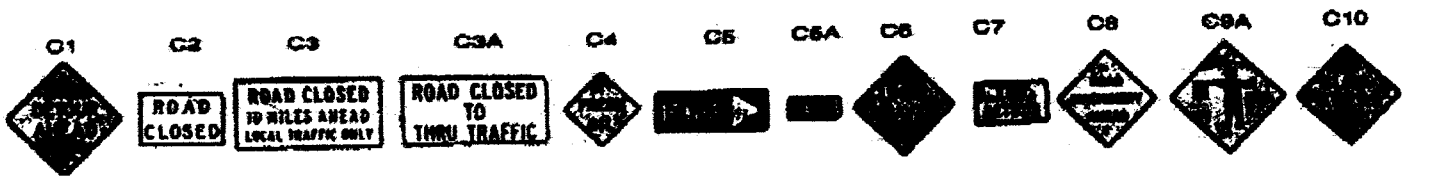
Type	Min. Size cm	Min Number of Panel Lamps	Min Legibility Distance Km
A	61x122	12	.80
II	92x183	13	1.21
I	122x244	15	1.61

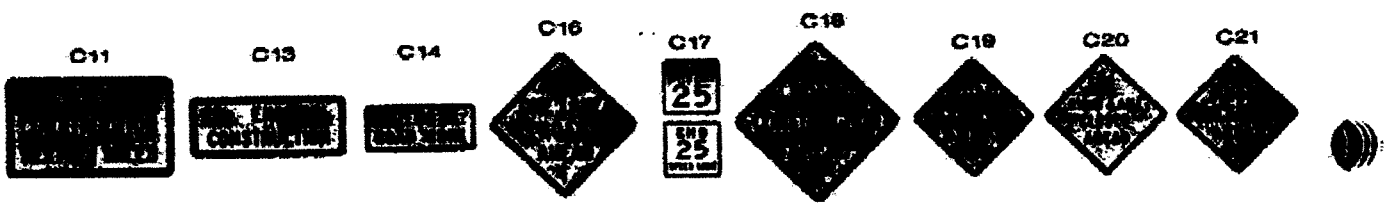

R1
R1-2
R1-A
R2
R2-4
35 ZONE AHEAD
R3
R4
TRUCK
R5
PATROLLED BY AIRCRAFT
R6
R7/R7A
KEEP RIGHT
R8
RUNAWAY VEHICLES ONLY
R10/R10A
ONE WAY
R11/R11A
R13
R15
NO PARKING
R16
R16B
NO RIGHT TURN
R17
R17B
NO LEFT TURN
R18-1
R18-2
RIGHT LANE MUST
R18A
RIGHT LANE MUST EXIT
R19
R20
R20A
R20B
R21
10 MPH 10 TONS
R24
R25
R26
R26(S)
R26A
R26A(S)
R26D
R26E
R26F
R26(S)
R27A(S)
R29
R30
R30A
R31
R31(S)
R32
R33A
R33B
R34
R34A
NO U TURN
R34-2
R35
R36
R37
R38
R39(S)
R40
R41
RIGHT TURN ONLY
R42
LEFT TURN ONLY
R43/R44
R44A
R44B
R44C
R45
EMERGENCY PARKING ONLY
R47
$500 FINE FOR LITTERING
R48
SPEED CHECKED BY RADAR
R49
R50/R51
R52
R53
TRUCK LANE 500 FEET
R53A
END TRUCK LANE
R53B
TRUCKS RIGHT LANE ONLY
R53C
TRUCKS USE RIGHT LANE
R54
R55
YIELD TO UPHILL TRAFFIC
R56
SLOWER TRAFFIC KEEP RIGHT
R57
BEGIN FREEWAY
R58
END FREEWAY
R61-1.1
R61-8S
R62A
R62-C
R62B
R63
DO NOT PASS
R64
R65
R67
R67A
R68
PASSING LANE AHEAD
R70
TRUCKS OK
R72
R73-2
R73-4
R74
R75
R76/R77
R78
R79
R80
R81
R81A
R81B
R82/R82A
R83/R83A
BUS CARPOOL LANE AHEAD
R84
R85
BUS CARPOOL LANE ENDS
R86
R87
BUSES AND CARPOOLS WITH 3 OR MORE
R88
DO NOT STOP
R89
R90
R91/R91A
CARPOOLS 2 OR MORE ONLY
R92
BUSES ONLY
CARPOOLS OK
6-10 AM
3-7 PM
MON-FRI
R93
CARPOOL IS 3 OR MORE PERSONS PER VEHICLE
R94/R94A
R95
R95A
R96
R96A
R96B
R98
R98A
R99
R100
R100A
R100B
R101

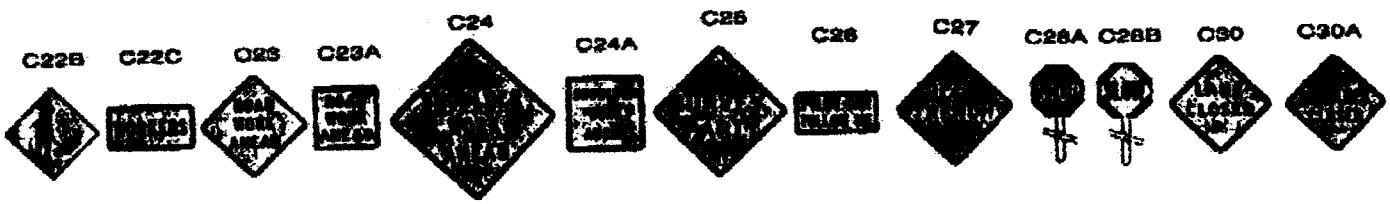
Warning Signs

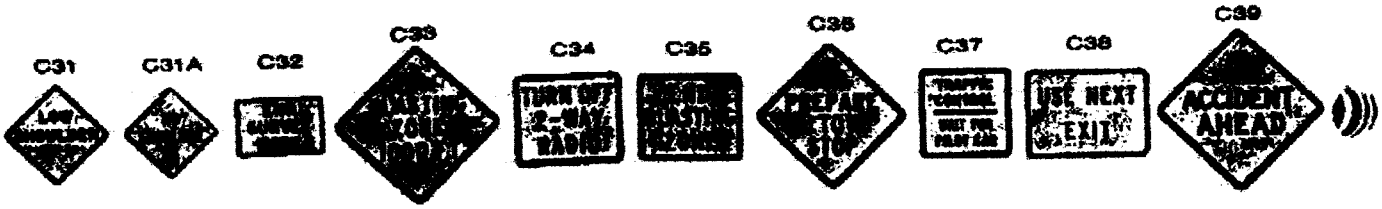


Construction Signs

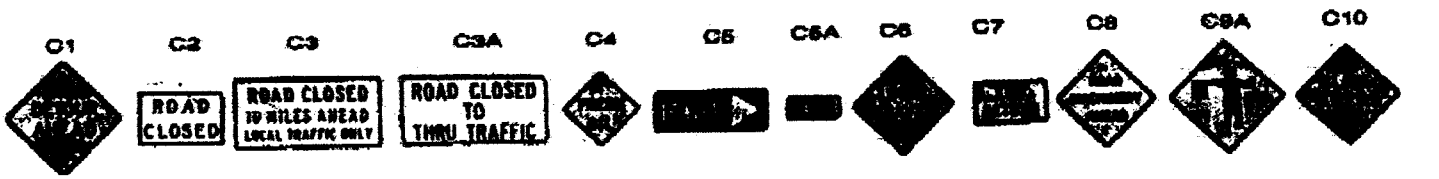


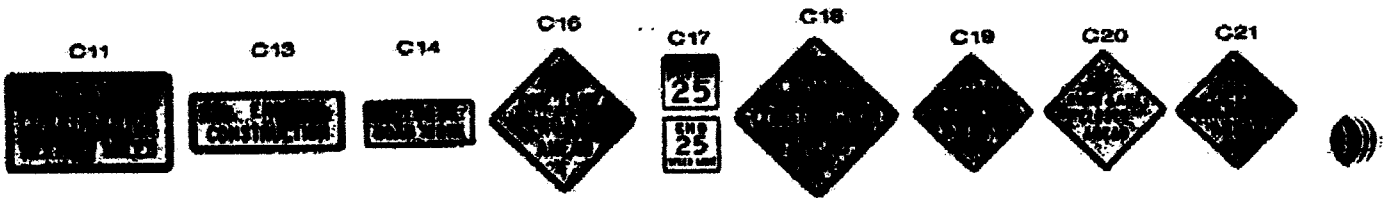


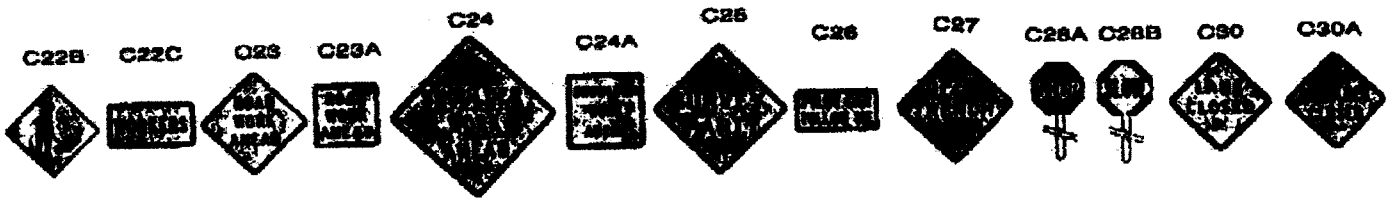


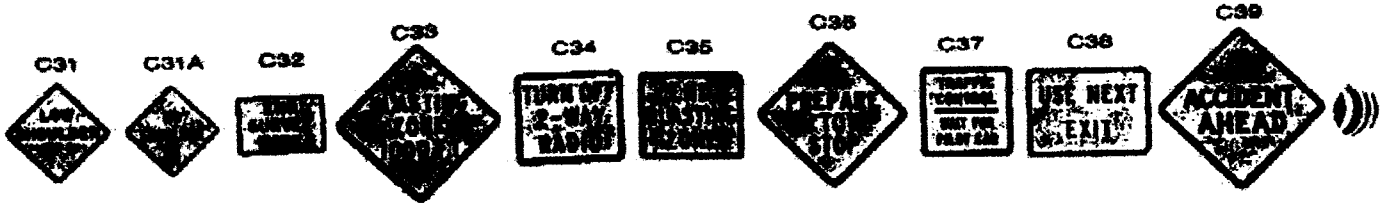


Construction Signs

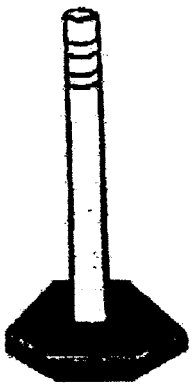




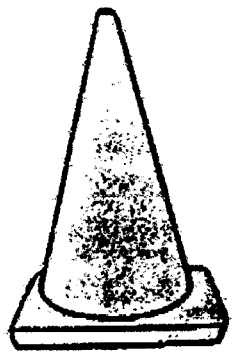




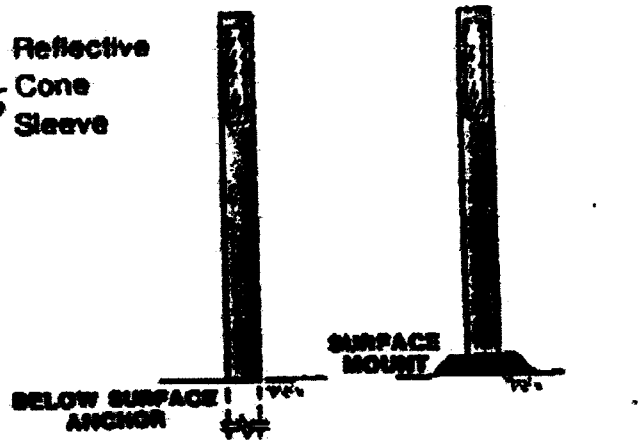
ACCEPTABLE CHANNELIZATION DEVICES



PORTABLE DELINEATOR
24" MINIMUM HEIGHT
61 cm



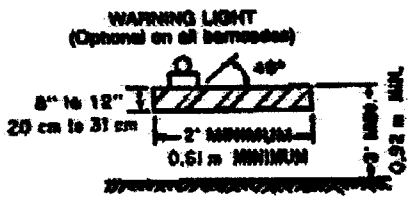
TRAFFIC CONE
24" MINIMUM HEIGHT
61 cm



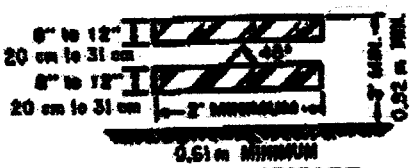
PERMANENT TYPE CHANNELIZER
24" MINIMUM HEIGHT
61 cm

NOTE: REFLECTORIZED MATERIAL FOR THE ABOVE DEVICES SHALL BE WHITE

TYPICAL BARRICADES



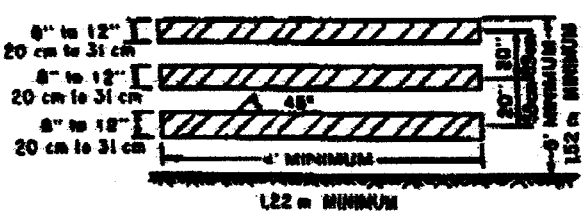
TYPE I BARRICADE



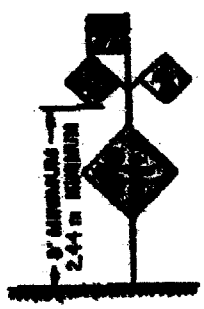
TYPE II BARRICADE

1742 cm²

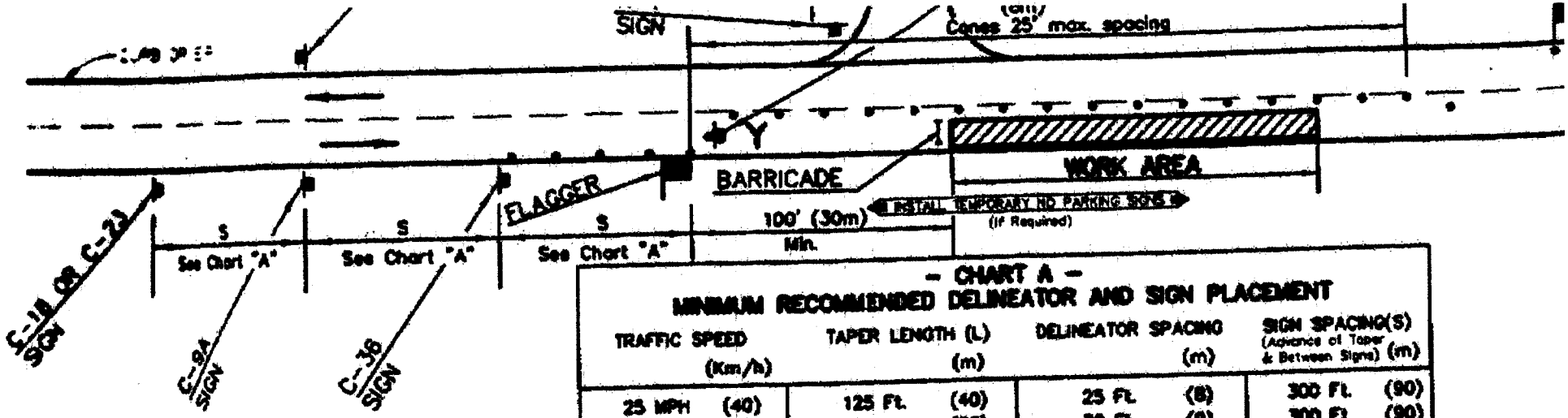
Note: Barricades shall have a minimum of 270 square inches of retroreflective area facing traffic when used on freeways, expressways, and other high speed highways.



TYPE III BARRICADE



HIGH LEVEL WARNING DEVICE
(Flagtree)



– CHART A –
MINIMUM RECOMMENDED DELINEATOR AND SIGN PLACEMENT

TRAFFIC SPEED (Km/h)		TAPER LENGTH (L) (m)		DELINEATOR SPACING (m)		SIGN SPACING(S) (Advance of Taper & Between Signs) (m)	
25 MPH	(40)	125 Ft.	(40)	25 Ft.	(8)	300 Ft.	(90)
30 MPH	(45)	180 Ft.	(55)	30 Ft.	(9)	300 Ft.	(90)
35 MPH	(50)	245 Ft.	(75)	35 Ft.	(11)	300 Ft.	(90)
40 MPH	(60)	320 Ft.	(100)	40 Ft.	(12)	320 Ft.	(100)
*45 MPH	(70)	540 Ft.	(165)	45 Ft.	(14)	540 Ft.	(165)
*50 MPH	(80)	600 Ft.	(185)	50 Ft.	(15)	600 Ft.	(185)
*55+MPH	(85)	1000 Ft.	(305)	50 Ft.	(15)	750 Ft.	(230)

1. A Flashing Arrow sign shall be used for each lane closed.
*2. Two lane closure signs (C–20) shall be used on the approach to a lane closure with speeds of 45 mph (70 Km/h) or greater.

NOTE: This chart based on 12–foot (4m) wide lanes. For lane widths greater than 12 feet (4m), use the following formulae:

Taper formula:

$L = S \times W$ for speeds of 45 mph or more.

$L = S \times \frac{2}{3} W$ for speeds of 70 Km/h or more.

$L = \frac{WS^2}{60}$ for speeds of 40 mph or less.

$L = \frac{WS^2}{150}$ for speeds of 60 Km/h or less.

Where:
L = Minimum length of taper.
S = Numerical value of posted speed limit prior to work or 85 percentile speed.
W = Width of offset.

i.e.: 50 mph and 19' lane; $L = 50 \times 19 = 950$ feet

i.e.: 60 Km/h and 6m lane; $L = \frac{6 \times 60^2}{150} = 144$ meters

INDICATE NORTH WITH A "N" AND AN ARROW POINT

LEGEND

- Traffic Cone or Delineator
- Sign
- Direction of Travel (Not a pavement marking)
- Flashing Arrow Sign (Where Required) Refer to Page 5 to select Type A, Type I , or Type II .
- High Level Warning Device (Flagtree)
- Barricade (For Excavation Only) Refer to Page 9 for Details on Type I , Type II , or Type III .
- Flagger